All contributions to be sent to the Editor, 19, St. Andrew's Mansions, Dorset Street, W.1.

# British Journal of Anæsthesia

VOL. XIII. NO. 2. JANUARY, 1936.

## ANÆSTHESIA: ITS PRESENT AND FUTURE

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*Anæsthetist to the General Infirmary at Leeds and to the Hospital for Women, Leeds; late Anæsthetist to the Leeds Dental Hospital.*

(*Continued from page* 32).

THE ideal scheme would be for a man to serve his apprenticeship as a resident before being eligible for the visiting staff. (This is, of course, impossible at present because resident anæsthetists are unknown at the hospital in question and because the fees paid by surgeons with such mediæval ideas of anæsthesia are inadequate to tempt outsiders to take up the work on a whole-time basis.) Then the surgeons would get reasonably satisfactory work from any newly appointed visiting anæsthetist. The resulting harmony and team work would be of benefit to all concerned, including the patient, that most important of all operating theatre inhabitants. Also, with resident anæsthetists available there would be some chance of "acutes" getting reasonably skilled anæsthesia, which at present they do not get.

Another practical defect is inherent in this system. A novice anæsthetist is always working with a surgeon of greater experience than himself—for novice surgeons are not allowed. Frequently the surgeon is very considerably the senior. This is a dangerous combination in the somewhat intolerant atmosphere of the operating theatre. Querulous demands from a senior for more relaxation are apt to be met by a panicky response and injudicious depth

of anæsthesia. This not only happens with the dresser-administrator, but also with the junior visiting anæsthetist, because his knowledge, for the first year or two after his haphazard appointment, is little more profound than the student's. But it definitely does not happen when a surgical team of no great discrepancy in seniority or experience works together constantly in hospital and in private.

Again, in proper team work, the surgeon can concentrate wholly upon his own part of it, undisturbed by the thought of anæsthetic disasters. So long as things are going well he will not be interrupted, but the experienced anæsthetist has no hesitation in informing him if circumstances warrant it. The surgeon working with a novice is constantly worrying about the anæsthetic, to the detriment of his own technique, yet, do what he will, he cannot supervise it properly or efficiently. Moreover, the novice will err in both directions. Not only will he stop the surgeon for some imaginary or purely trivial emergency which ought never to have arisen, but he will probably fail to recognise and proclaim a real emergency when it occurs.

The visiting anæsthetists in question are all part-time general practitioners. This at once raises the point, general practitioner or specialist? (Of course, it is evident that in the smaller hospitals the whole of the staff must frequently be general practitioners. These remarks apply only to large teaching hospitals situated in areas of dense population.) It has been said with some truth that a specialist is a man who knows more and more about less and less, and a general practitioner is a man who knows less and less about more and more. Consequently, there is something to be said for a part-time specialist who is also in general practice. He gets enough of his special work to acquire considerable skill and experience (though, as pointed out above, it should be obligatory to hold a resident post before appointment. No man should be compelled to learn the rudiments of his work after his election to a senior post), while his general work preserves him from narrow-mindedness and develops his clinical instinct. He is perhaps better than the specialist at rapid evaluation of condition and risk from personal appearance, and his knowledge may occasionally act as a check upon errors of diagnosis.

For these reasons the custom (which is fairly common in large hospitals—in this department only, be it observed—from others the general practitioner is rigidly excluded) has certain advantages. But it also has its defects, the chief of which is the time factor. The average general practitioner is a busy man, especially if he adds to his practice several operating lists every week. Consequently, however enthusiastic he may be it is impossible for him to see the patients beforehand and to follow them up afterwards. This is a very serious defect which prevents full advantage being taken of the anæsthetist's experience and which effectually prevents useful research work. Proper record keeping (of the kind described below) is absolutely out of the question.

Those who are fortunate enough to see their patients beforehand as a routine do not perhaps realise the dilemmas which sometimes arise when the anæsthetist does not come in contact with the case until the actual moment of operation. The patient's physical and mental condition are unknown quantities, save for the knowledge gleaned from a rapid glance, and the risk involved has to be navigated by guess and by God. To give an example—not a theoretical one, but a case which occurs in actual practice—of the extreme danger to the patient inherent in this haphazard method. A patient is put on the operating list for an appendicectomy—the anæsthetist arrives and the operation begins. When the abdomen—that diagnostic lucky bag—is opened the surgeon finds a gastric ulcer. He promptly enquires whether the patient will stand a gastrectomy. The unfortunate anæsthetist is thus expected to answer a question of such vital importance—and the penalty for a wrong answer is death—without any previous examination of the patient. The absurdity and the unfairness of the situation is obvious—but only, apparently, to the anæsthetist. The patient, whom it concerns most closely, does not even know that such problems arise; the surgeon knows, but with certain honourable exceptions, does not do anything about it. The only conceivable reason for this neglect is an unworthy one—a preliminary examination would diminish his profits by a small amount.

There is another disadvantage in the general practitioner

anæsthetist system as at present worked in many hospitals, though this defect is not inherent in the system itself. The anæsthetists, who spend hours a week in practically gratuitous hospital work in order to improve their knowledge and skill, are generally paid general practitioner fees for private work, regardless of their special experience and regardless of money spent on expensive apparatus. Unlike the surgeons, they do not get private fees of compensatory magnitude. Many surgeons pay the same fee, and that a small one, to their hospital anæsthetist of twenty years' standing and to a newly qualified man whose experience is limited to a couple of dozen cases.

It may be argued that even if private fees are so small and so limited in number that the anæsthetist cannot make a living out of them, still they are a useful addition to general practice receipts. This is true, but this argument ignores the damaging effect of hospital work on general practice. Frequent and prolonged sessions in the operating theatre cause infinite harm to a practice, partly because of the inaccessibility of the practitioner and partly because of the time consumed.

Of recent years many hospitals have built private wards for paying patients, from whom the anæsthetists receive a small amount in fees. It is true that these are earned without appreciable extra work in that the cases are done in the course of the ordinary operating lists, but it is also true that they are often far too small. In one case hospital rules fix the surgeon's maximum fee at 25 guineas and the anæsthetist's fee at one guinea. This is out of all proportion and absurdly inadequate. Such a nominal rate, considering the limited number of private ward cases, provides merely an honorarium and is in no sense a recompense for the time spent in hospital.

More important still, for this point affects the welfare of the patient, these cases are paying fees with the deliberate intention of securing a high degree of skill and experience and a certain degree of personal care which they fear they might not receive in the public wards. From the surgical aspect they get what they pay for, because they are always, for obvious reasons, operated upon by the surgeon himself and never delegated to the house surgeons. But they are

not by an means certain of obtaining a fair deal as regards the anæsthetic. The fee is so small that it is not worth while for the visiting anæsthetist to make a special journey for emergencies, which are anæsthetised by the house surgeon. Alternatively, the house surgeon wants the fee himself, so he omits to telephone. Whatever the cause the acute cases pay the fees demanded (it is not their fault that they are inadequate to tempt an experienced man) in the pathetic and deluded belief that they are getting something rather special. In any other trade this practice would be stigmatised as false pretences and treated as such.

The medical profession ranks high in honour with the nations of the world, but if we have not an understanding heart then is our honour but a dishonourable sham. If we tolerate inferior service when dealing with lives entrusted to our care in simple good faith then we are perpetrating a fraud upon the public, and a fraud which stands out above all others in its meanness and iniquity because the vicitims do not even know that they are defrauded. A future of increasing interest and greater safety awaits the art of anæsthesia if only the eyes of the surgical and lay public can be opened, if only they can be brought to realise that good anæsthesia is worth having and that better anæsthesia is worth striving for and incidentally worth paying for.

Under the rule of the god-of-things-as-they-are the ideals of many potentially keen anæsthetists are extinguished, and the flaming enthusiasm which might so easily lead to advancing knowledge and efficiency is damped down by the dead and paralysing weight of economic pressure. It is a small matter as far as the anæsthetists are concerned, for a man or woman on the Medical Register can make a living with perhaps greater certainty than any other trade or profession in the world. But above all things and beyond all things it is our sacred duty to work for the restoration of the obsolescent but rather noble ideal which was the strength and glory of our profession in the days of the Hippocratic oath—that the welfare of the patient outweighs every other consideration whatsoever.

Surgical fees were ever extortionate, but with pitiful eagerness the patients demand the best and pay for it unto the uttermost farthing. It is a tragedy of infinite pathos

that, having paid, it should be denied them in order that a few guineas may be saved out of an already large fee. So long as this attitude of mind persists so long will the much vaunted reputation of modern surgery continue to be mere bally-hoo for advertisement purposes.

This paper will not deal with the problem of unpaid anæsthetists attached to professorial units with salaried surgeons, from whom there is no chance of earning private fees, because it so happens that the writer has not visited any hospitals where this system is in force. In the absence of evidence to the contrary, therefore, he is bound to assume that this particular problem affects the anæsthetist only and has no adverse bearing upon the patient. The purpose of the present essay is to deal only with matters which affect the patient, directly or indirectly.

The question now arises, can the average operative mortality be reduced, and if so by what means can we advance along this pathway to great adventures and limitless service? In an attempt to find out what the average mortality is I chose one of the hospitals to which I am attached because its statistics were easily accessible. It is large, it deals with all types of case, it has a high reputation and may be taken as a fair representative of the voluntary general hospitals.

The death rate from operative surgery at the General Infirmary at Leeds remains at a remarkably steady level*:

| | | | |
|---|---|---|---|
| 1925 | 4.91% | 1929 | 4.82% |
| 1926 | 4.09% | 1930 | 4.31% |
| 1927 | 3.74% | 1931 | 3.92% |
| 1928 | 4.20% | | |

Considering the amount of major surgery (about 30 per cent of abdominals) and bad risks the results seem good at first sight and are probably not inferior to those of most hospitals. But is it possible to reduce this average of 4.28 per cent? Do any other hospitals in fact contrive to undercut it? An answer is given in the statistical reports of the Rotherham Hospital, where the operation list reaches the

* These figures include, for both hospitals, both immediate and remote mortality—that is, deaths on the table and deaths *after operation* while the patient is still in hospital. The latter are not so dramatic, but they are just as imporant.

smaller but still respectable total of 1,200 a year. The Rotherham death rate has been reduced in the following striking manner:

| | | | |
|---|---|---|---|
| 1925 | 4.4% | 1929 | 1.9% |
| 1926 | 4.0% | 1930 | 1.0% |
| 1927 | 3.8% | 1931 | 1.7% |
| 1928 | 3.9% | | |

It will be seen that the mortality rate was very much the same for both hospitals up to and including 1928, but that Leeds has not improved at all, unlike Rotherham, which has reduced its death rate by an average figure equivalent to 2.346 per cent of the total number of operations. Now 2.346 per cent on the average operation figures of all hospitals with a mortality rate in the region of 4–5 per cent represents a very large number of human lives.

These two series of statistics cover long periods and are of considerable magnitude. Moreover they are strictly comparable. I personally interviewed the compiler of the Rotherham figures before collecting my own, and great care was taken that the methods used were exactly the same. The remarkable consistency and steadiness of the pre-1929 death rates is all in favour of their reliability. In both series the percentage of abdominals was about the same.

The first problem to be solved: is the surgeon or the anæsthetist at fault? It is not argued that Rotherham surgeons are better than Leeds surgeons—the Rotherham improvement was solely due to anæsthetic reforms, other conditions remaining the same.

A recent visit to the United States gave me the impression that the surgery I saw there was similar to the average English standard, but the anæsthetic organisation, personnel, equipment and tuition were incomparably superior in every way. This refers to Madison, Wisconsin, and Toledo, Ohio, admittedly chosen for visits because of their outstanding anæsthetic reputation. Not all American hospitals are up to this high standard, but the inferior ones can be ignored. Only the best are good enough to learn from and to imitate.

On my trip I saw many details of hospital organisation which could be adopted here with great advantage to the

comfort and safety of the patients, to the reputation of the hospitals and to the ultimate profit of the surgical staff. It will be convenient to describe first the anæsthetic organisation perfected by Dr. Ralph M. Waters at the State of Wisconsin General Hospital at Madison, and then the Toledo technique of Dr. E. I. McKesson.

*A.* The State of Wisconsin General Hospital contains about 600 beds. The anæsthetic staff consists of Dr. R. M. Waters as chief, with two permanent assistants and two assistants appointed for a year. All these are whole-time appointments, but the seniors can take private anæsthetic work, most of which is done in the hospital and which causes no departure from the usual routine.

(*a*) *Pre-operative routine at Madison.*

When time permits, that is in every case except the most urgent, the names of patients for operation are sent to the anæsthetist's office beforehand. It is the duty of the anæsthetist to visit each case prior to operation and to fill up from the notes and from personal examination a very complete record of the patients' physical condition on a special form supplied for the purpose. At the same time he orders whatever preliminary medication he thinks fit. This examination ensures that a record is kept, which is of real value for statistical purposes, and it also allows the anæsthetist an opportunity to estimate the risk he is to undertake and to obtain valuable information which may affect the choice of technique, etc. Contrast with this forethought and care the haphazard method by which the anæsthetist does not see the patient at all until he arrives in the theatre.

(*c*) *Madison procedure during operation.*

Blood-pressure readings are taken during operation as a routine, so that the patient's condition, already familiar to the anæsthetist, is constantly under observation. These readings are no trouble, as carried out in this hospital. The sphygmomanometer armband and the stethoscope tambour are strapped in position beforehand by the porter, and the armband is automatically inflated by the gas machine when necessary. The blood-pressure readings, together with many other details, are recorded on the anæsthetic chart previously mentioned, which accompanies each patient to

the theatre. Needless to say, in a hospital where the patient's safety is considered with such extreme care no unsupervised student is ever permitted to give an anæsthetic.

(*c*) *Post-operative routine.*

All cases are seen by the anæsthetist after operation and the visits repeated if necessary for the completion of the anæsthetic record. The anæsthetist is also called in to see any cases of post-anæsthetic complications. This follow-up work is of great importance in risk-estimation. If the anæsthetist does not see the results of his work, as in so many English hospitals, his judgment as to patients' condition can never improve. The value of his years of previous experience is, in this respect, practically nil.

(*d*) *Records.*

The record sheets at Madison, which are filled up before, during and after operation, find their way when complete to the anæsthetists' office. Here, by means of a simple little machine, a card is punched to correspond with each one. The record is then bound with the case papers and the card filed in the office. Each card contains no less than 450 positions for punch holes, so that an enormous amount of information is recorded quickly by this system. When large numbers of cards have been accumulated any desired information can be extracted from them very rapidly by passing them through a sorting machine.

The cause of "epidemic" accidents or complications in surgery or anæsthesia may be detected from the cards. Accurate comparative studies may be made showing the advantages (if any) of changes of method or technique. By this system and this alone can the value of small alterations be judged with reference to the ultimate criterion of all surgery—the death rate.

(*e*) *Research at Madison.*

Each anæsthetist is responsible for reading certain journals and publications from which he picks out and summarises articles of anæsthetic interest. The whole staff is thus kept informed of day-to-day progress.

There is close co-operation between the anæsthetic staff and the physiological and pharmacological departments of the University of Wisconsin. It was here that the carbon dioxide absorption method was developed from a casual

pharmacological suggestion into a practical and useful anæsthetic technique. It was here also that several years of combined research on animals resulted in the introduction of cyclopropane, a new gas of great promise, which at the time of my visit was in actual use in the operating theatres. (Incidentally the card system will enable the advantages and disadvantages of cyclopropane to be accurately compared with the older methods in scores of different ways. Its true position in the anæsthetist's armamentarium will not take eighty years to solve, as did the controversy between ether and chloroform.).

(*f*) *Tuition.*

This is very thorough. All students are put through an intensive course of anæsthesia and operative surgery on animals before being allowed to try their hands upon human patients. This is a distinct improvement on our method of allowing them to practise upon the poorer members of the community. Finally, all students devote five weeks' full time to human anæsthesia.

(*g*) *Equipment.*

This is on a lavish scale. Even in the County hospitals, which roughly correspond to our Workhouse Infirmaries, anæsthetic gases are piped to the operating theatres from a central supply room. This relieves the anæsthetist of all anxiety about shortage of gas during an operation and of the necessity for changing cylinders. No gas machine depending on small cylinders for its supply is any use for hospital work. The cylinders are left partly empty or completely empty by other users, and it is always necessary before using, and frequently during an operation list, to test and change them. This is such an intolerable nuisance that gas machines are rarely used under such conditions, even if available. In America the standard size is 3,000 gallons, which is fitted and forgotten for fifty or sixty hours of use. This point is more important than it sounds in obtaining efficient work. Also, gas in large cylinders is cheaper than in small ones.

In the Madison hospitals there were thirteen Foregger gas machines and two McKessons. Contrast with this the meagre equipment of the average British institution.

The department of anæsthesia in American hospitals has

charge of all apparatus for oxygen therapy and resuscitation—the Drinker respirator, which mechanically performs artificial respiration in cases of paralysis or respiratory failure, oxygen tents with their soda lime purifiers and refrigerators, and the specially built oxygen rooms, where patients can be nursed for weeks if need be in an atmosphere of almost pure oxygen.

*B. The Toledo technique.*

McKesson has always claimed that all cases and all patients can be dealt with by gas and oxygen alone, with its advantages of increased safety and non-toxicity, rapid recovery and absence of after-effects. This claim appeared to be exaggerated, because no one seemed to be able to employ gas and oxygen so successfully. As generally used it has very severe limitations owing to its lack of power.

McKesson's claim is, however, perfectly correct. I have seen him use it, and in his hands it achieves the impossible and does all that he claims. While this degree of expertness cannot be expected from everybody, there is no doubt that gas and oxygen can be given in a far wider range of cases than generally thought possible, if only the Toledo technique is learnt. Seventy-four per cent of my last 150 private cases have had gas and oxygen alone and a good many of the remainder gas and oxygen with minimal amounts of ether. Given even moderate skill in its use no non-abdominal case need suffer the unpleasantness and risk of ether or chloroform, and with increasing practice a large proportion of abdominals can also be spared this risk.

*It was by the wholesale use of gas and oxygen in this manner that the Rotherham mortality was reduced so markedly.*

In order to use gas and oxygen (as distinct from gas-oxygen-ether or gas-oxygen-chloroform) McKesson's apparatus is essential. I had the opportunity of carefully examining and actually using other makes while in America and I have also used other British makes, but I am convinced that all of them are very much inferior to it in efficiency, convenience, and workmanship.

With anæsthetics such as ether or chloroform simple improvised apparatus can be used with success, but with gas and oxygen instruments of precision are absolutely

essential. A machine which will deliver oxygen in steps of approximately 20 per cent are not good enough, any more than a coal-waggon weighbridge is good enough for dispensing purposes. A given patient may require seven per cent of oxygen, no more and no less. With five per cent he is dangerously anoxæmic and with nine per cent he is not properly under. One reason why so many are unable to get satisfactory results from the use of nitrous oxide without the addition of ether in the majority of cases is the use of inefficient apparatus which will not deliver accurate and constant percentage mixtures, regardless of variations in flow from the cylinders. Accuracy to one per cent is necessary.

## Conclusions.

1. It is possible to reduce post-operative mortality below the 4–5 per cent average.

2. There are many defects in the anæsthetic departments of different hospitals, and until these are remedied the operative death rate will always be higher than it need be. These defects constitute a grave blot on twentieth-century surgery.

3. The ideal reform would be to adopt in its entirety the almost perfect Madison organisation, but replacing continuous flow machines by McKesson's, used as they are used at Toledo. For safety and all-round efficiency the hospital which did this would lead the world.

4. If such changes are impossible then certain minimum essentials are required to create a satisfactory service.

(*a*). Resident anæsthetists should be appointed at all large hospitals without exception.

(*b*). No person should be appointed as visiting anæsthetist without previous experience as resident, thus bringing anæsthesia into line with all other branches of medicine and surgery.

(*c*). Anæsthetic clerkships should be compulsory for the better instruction of students.

(*d*). It should be an absolute rule that no dresser is allowed to give an anæsthetic except under direct supervision.

(*e*). Patients in private wards should invariably get what they pay for—the personal care of an experienced

anæsthetist. Under no circumstances should the same fee be payable to a senior member of the staff and to a newly qualified house surgeon.

(*f*). The equipment of many hospitals requires drastic overhaul. Good modern gas machines should always be available.

(*g*). These machines, though robust, are not fool-proof. Therefore, no one except people familiar with their construction and mechanism should be allowed to use them or they will never be in working order. (Nor will satisfactory anæsthesia be obtained.) Financial considerations in the form of repair bills may thus do what the interests of the patient have failed to do, that is, protect patients against the dangers of unskilled and unsupervised anæsthesia.

(*h*). As the science of anæsthesia is constantly changing and constantly advancing, in common with the rest of medicine and surgery, provision should be made so that suggestions for reforms and improvements could be brought to the notice of the governing body without loss of time.

## Appendix.

A few more figures of interest from the Rotherham reports:

| | 1st Period. 1925–1928. Ether and Chloroform. | | | 2nd Period. 1929–1931 Gas and Oxygen largely used. | | |
|---|---|---|---|---|---|---|
| | Cases | Deaths | Mortality | Cases | Deaths | Mortality |
| Hysterectomy ... ... | 71 | 8 | 9.7% | 48 | 0 | 0% |
| Gall Bladder operations ... | 81 | 9 | 10.1% | 61 | 2 | 3.2% |
| Appendicectomy ... ... | 696 | 23 | 3.3% | 482 | 4 | .8% |
| Total in-patient operations | 4721 | 183 | 3.876% | 3770 | 58 | 1.53% |

The surgical staff was the same all the time.

I have to thank Dr. E. J. Chambers of Doncaster for the loan of these reports. He, like myself, is a gas and oxygen enthusiast, but his figures are uncontaminated by enthusiasm. They are taken from the annual reports of the hospital, in the compilation of which anæsthetists take no part whatever.

## THE JOURNAL'S PRIZE ESSAY

THE Editorial Board has decided to offer another prize, value ten pounds, for the best essay on any subject directly concerned with the administration or the physiology of anæsthetics.

The essays must reach the Editor of the *Journal* on or before August 31st, 1936, should not exceed four thousand words in length, and must be typed or written on one side of the paper only. The Board claims the right to publish any of the essays submitted. Candidates must hold a medical qualification within the British Empire.

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## THE DIPLOMA IN ANÆSTHETICS

THE following practitioners, in addition to those whose names were published previously, were granted the diploma under the regulation permitting this without examination: G. F. V. Anson, Herbert Charles, L. T. Clarke, Elsie C. Hanson, O. J. Murphy, J. D. Stewart, L. N. Routh, S. T. Rowling.

The first examination was held on November 8th and subsequent days. The list of successful candidates is as follows:—

H. K. Ashworth, M.B., Ch.B. (Manch.), L.R.C.P., M.R.C.S.
J. H. Atwood, M.B., B.S. (Lond.), L.R.C.P., M.R.C.S.
A. Barnsley, M.D., B.Chir. (Camb.), L.R.C.P., M.R.C.S.
C. A. Borland, M.B., Ch.B. (Glasgow).
Lorna Bray, M.B., B.S. (Melb.).
H. J. Brennan, M.B., Ch.B. (Manch.).
R. J. B. Broad, L.R.C.P., M.R.C.S.
A. I. P. Brown, M.B., B.S. (Lond.), L.R.C.P., M.R.C.S.
F. F. Cartwright, L.R.C.P., M.R.C.S.
T. H. Chadwick, M.B., Ch.B. (Manch.).
D. J. Davies, M.B., B.S. (Lond.), L.R.C.P., M.R.C.S.
Winifred Dean, M.B., Ch.B. (Manch.).
H. G. Dodd, M.B., B.S. (Durham).
N. A. Gillespie, D.M., B.Ch. (Oxon).
J. Gillies, M.B., Ch.B. (Edin.).
A. P. Gorham, M.B., Ch.B. (Bristol), L.R.C.P., M.R.C.S.
R. B. Gould, M.B., Ch.B. (Sheffield).
H. F. Griffiths, M.D., B.Ch. (Camb.), L.R.C.P., M.R.C.S.

Gwendolen Harrison, M.B., Ch.B. (Leeds).
G. Hochschild, L.R.C.P., M.R.C.S.
Mary J. Hudson, M.B., Ch.M. (Sydney).
R. Jarman, L.R.C.P., M.R.C.S.
E. F. Johnson, M.B., B.S. (Lond.), L.M.S.S.A. (Lond.).
Alison R. Kerridge, L.R.C.P., M.R.C.S.
L. H. Lerman, L.R.C.P., M.R.C.S.
A. Lucas, L.M.S. (Ceylon), D.T.M. & H. (Eng.), L.R.C.P. & S., (Edin.), L.R.F.P.S. (Glas.).
W. S. McConnell, M.B., B.S. (Lond.), L.R.C.P., M.R.C.S.
Jean Small Blair McNeil, M.B., Ch.B. (Edin.).
S. V. Marshall, M.B., Ch.M. (Sydney).
E. A. Marson, M.B., Ch.B. (Manch.).
A. G. Miller, M.B., Ch.B. (Glasgow).
J. C. Nicholson, M.B., Ch.B. (Manch.).
M. D. Nosworthy, M.D., B.Ch. (Camb.), L.R.C.P., M.R.C.S.
E. A. E. Palmer, M.B., B.Ch. (Camb.), L.R.C.P., M.R.C.S.
B. Rait-Smith, L.R.C.P., M.R.C.S.
E. H. Rink, B.M., B.Ch. (Oxon.), L.R.C.P., M.R.C.S.
F. W. Roberts, M.B., B.S. (Lond.), L.R.C.P., M.R.C.S.
K. MacD. Ross, M.B., B.S. (Lond.), L.R.C.P., M.R.C.S.
Doris M. Sanders, M.B., Ch.B. (Birm.).
J. D. Scott, L.R.C.P., M.R.C.S.
E. V. Slaughter, L.R.C.P., M.R.C.S.
C. E. Sykes, M.B., Ch.B. (Manch.).
Sheina Cooper Helen Watters, M.B., Ch.B. (Edin.).
J. H. West, L.R.C.P., M.R.C.S.
Rose Eleanor Williams, L.R.C.P., M.R.C.S.
F. C. Wright (Surg.-Com. R.N.), L.R.C.P., M.R.C.S.

As some guide for future candidates we here append a few of the questions from the paper set in the first examination:

Give the points for and against spinal anæsthesia. Describe the technique that you employ, with doses.

You are called to a case of intestinal obstruction with almost constant vomiting. It is decided to do an exploratory laparotomy. What will you do? Describe in detail.

Write a short essay on the history and present position of rectal anæsthesia and analgesia.

What premedication and anæsthetic would you employ in a case of bad toxic goitre?

# INVESTIGATIONS INTO THE UREA NITROGEN CONTENT OF BLOOD FOLLOWING ANÆSTHESIA

By EILEEN A. BOYD, M.B., B.Ch. (*Dublin University*).

(*Research Assistant, The Devonport Pathological Laboratories, Greenwich, S.E.*10).

## INTRODUCTION

By RONALD JARMAN, M.R.C.S., L.R.C.P.

(*Late Anæsthetist The Dreadnought Hospital, Greenwich*).

THE following work was undertaken with the object of finding out if any changes in urea nitrogen content of the blood were produced by spinal anæsthesia, and whether or not there was any definite advantage in giving an inhalation anæsthetic rather than a spinal.

A series of normal controls was tested against a series of patients anæsthetised by various methods, e.g. by chloroform, ether, stovaine and percaine spinal. The results obtained are of value insomuch as the physician and surgeon in charge of any patient may know that certain types of anæsthesia do not produce any alteration in the urea nitrogen content of the blood, even if pathological changes in the kidneys are present. Referring to the results from ether anæsthesia, it will be seen that there are definite signs that this anæsthetic does bring about changes in the blood chemistry. This is confirmed by Dr. Shackle's findings.

The investigation is of value in showing that some types of anæsthetic do not produce any changes outside the normal range in the urea nitrogen content of the blood, and that of all types of anæsthetic, nitrous oxide and oxygen produces the minimum changes in the blood chemistry.

Reference has been made in previous communications[1] to the absence of toxic effects during anæsthesia by nitrous oxide and oxygen.

[1] Jarman. *British Medical Journal*. May 5, 1934.

THE following records a series of investigations into the urea nitrogen content of the blood of patients at The Dreadnought Hospital, Greenwich, before and twenty-four hours after administration of general and spinal anæsthesia; with 50 non-surgical cases as controls. They were carried out on the suggestion of Dr. Ronald Jarman.

The patient's fasting blood was taken on the morning of the operation before any premedication.

A second specimen was taken the following day, approximately twenty-four hours after administration of anæsthetic.

*Technique.*

A colorimetric micro-technique was employed. A 0.2 cubic centimetre of finger-prick blood is taken directly into a centrifuge tube containing one cubic centimetre of distilled water, and 0.3 cubic centimetre of urease solution added. (Urease solution is prepared by grinding up one urease tablet with five cubic centimetres of distilled water). The tube is then incubated in a water bath at 57°C. for half an hour.

The proteins are precipitated with 0.3 cubic centimetre each of $2/3NH_2SO_4$ and 10 per cent sodium tungstate, the volume made up to eight cubic centimetres and the whole centrifuged.

To five cubic centimetres of the resulting clear supernatant fluid (containing 0.125 cubic centimetre of blood), are added two cubic centimetres of Nessler's reagent and a reading made immediately against a solution of ammonium sulphate containing 10 milligrams per cent of ammonia nitrogen Nesslerised in the same manner.

Fifty cases of chloroform and ether anæsthesia, fifty cases of stovaine and forty-three cases of percaine were examined. Fifty medical cases were used as controls, their ages varying between twenty and fifty. None of the patients showed any renal abnormality and they could be assumed to have a normal blood urea nitrogen content—12–15 mgm. per cent. Their fasting blood was taken at the same hour in the morning on two consecutive days.

In the controls it was found that only four per cent gave

identical readings. In the remainder there was a daily variation of moderate amount; either a decrease or an increase, as detailed below.

Both in cases of general and spinal anæsthesia, a moderate variation in the blood urea nitrogen content was demonstrated as detailed below.

*Controls* (50 cases).

Twenty-five cases, 50 per cent showed an average decrease in the urea nitrogen content of 2.9 mgm. per cent.

Maximum decrease: 10.4 mgm. per cent.
Minimum decrease: 0.3 mgm. per cent.

Twenty-three cases, 46 per cent gave an average increase of 3.3 mgm. per cent.

Maximum increase: 9.2 mgm. per cent.
Minimum increase: 0.2 mgm. per cent.

Two cases, or four per cent, gave identical readings on two consecutive mornings.

*Chloroform and Ether* (50 cases).

Thirty-one patients, or 62 per cent, showed an increase in the urea nitrogen content of their blood twenty-four hours after operation. The average increase was 3.8 per cent.

Maximum increase: 19 mgm. per cent.
Minimum increase: 0.3 mgm. per cent.

In sixteen patients, 32 per cent, the urea nitrogen was decreased. The average decrease being 1.9 mgm. per cent.

Maximum decrease: 7.2 mgm. per cent.
Minimum decrease: 0.2 mgm. per cent.

Three cases, or six per cent, showed no change.

*Stovaine* (50 cases).

Twenty-six cases, or 52 per cent, had increased urea nitrogen values after operation, averaging 3.7 mgm. per cent.

Maximum increase: 9.5 mgm. per cent.
Minimum increase: 0.6 mgm. per cent.

Nineteen cases showed a drop in the urea nitrogen content the day following operation, averaging 2.7 mgm. per cent.

Maximum decrease: 9.6 mgm. per cent.
Minimum decrease: 0.5 mgm. per cent.

Five cases, or 10 per cent, showed no change.

*Percaine* (43 cases).

In twenty-two, or 51 per cent, of the cases investigated a rise in the blood nitrogen was noted, averaging 3 mgm. per cent.

Maximum increase: 8.5 mgm. per cent.
Minimum increase: 0.4 mgm. per cent.

Sixteen cases, or 37.3 per cent, had a lowered urea nitrogen content following operation, averaging 1.6 mgm. per cent.

Maximum decrease: 5.5 mgm. per cent.
Minimum decrease: 0.2 mgm. per cent.

Five cases, or 11.5 per cent, gave identical readings.

In the majority of these cases the food intake on the day following operation was negligible. Actually many of the cases who had had dinner at midday had a lower blood urea nitrogen content than those who had had no dinner.

No opportunity was afforded for investigating cases of ether anæsthesia, but Shackle[2] reports a considerable rise in twenty-seven out of thirty-five cases undergoing gynæcological operations at Guy's Hospital with induction by ethylchloride and chloroform and ether. He found increased values up to 41 mgm. per cent, with an average of 21 mgm. per cent.

Pitt[3] has studied the influence of avertin anæsthesia on the renal function and found a slight rise in the blood urea following administration of avertin with nitrous oxide and oxygen, and a greater rise after avertin with ether and chloroform.

## Conclusions.

The average rise in the urea nitrogen content of the blood of all cases under examination is no greater than the average daily variation in normal controls. It is, however, apparent from the table given below, that a greater percentage of cases of inhalation anæsthesia than of spinal anæsthesia shows this increase. It is also demonstrated that the average rise in milligrams per cent of urea nitrogen is slightly greater following general than spinal anæsthesia.

[2] Shackle. *Journ. Clin. Research*, Oct., 1932, p. 138.
[3] Pitt. *Lancet*. March 30, 1935, p. 741.

| | Controls | $CHCl_3$ | Stovaine | Percaine |
|---|---|---|---|---|
| Increase per cent ... ... | 46 | 62 | 52 | 51 |
| Decrease per cent ... ... | 50 | 32 | 38 | 37·3 |
| Average rise in mgms. per cent Urea N. ... ... ... ... | 3·3 | 3·8 | 3·7 | 3·0 |

CONTROLS (NO ANÆSTHESIA).

| Case | Mgm. of Urea N. 1st Day | 2nd Day (24 hrs.) | Mgm. of Urea M. Increase | Decrease |
|---|---|---|---|---|
| 1 ... ... | 13.3 | 18.8 | 5.5 | |
| 2 ... ... | 14.5 | 17.0 | 2.5 | |
| 3 ... ... | 26.6 | 16.0 | | 9.5 |
| 4 ... ... | 15.2 | 14.5 | | 0.7 |
| 5 ... ... | 8.2 | 12.3 | 4.0 | |
| 6 ... ... | 20.0 | 14.4 | | 5.6 |
| 7 ... ... | 22.8 | 20.0 | | 2.8 |
| 8 ... ... | 13.3 | 12.0 | | 1.3 |
| 9 ... ... | 16.6 | 11.8 | | 4.8 |
| 10 ... ... | 10.0 | 15.2 | 5.2 | |
| 11 ... ... | 15.2 | 17.7 | 2.5 | |
| 12 ... ... | 16.0 | 14.5 | | 1.5 |
| 13 ... ... | 9.4 | 9.0 | | 0.4 |
| 14 ... ... | 10.6 | 10.0 | | 0.6 |
| 15 ... ... | 16.0 | 15.2 | | 0.8 |
| 16 ... ... | 12.3 | 10.7 | | 1.6 |
| 17 ... ... | 11.4 | 11.8 | 0.4 | |
| 18 ... ... | 12.3 | 13.3 | 1.0 | |
| 19 ... ... | 10.7 | 14.0 | 3.3 | |
| 20 ... ... | 17.0 | 14.0 | | 3.0 |
| 21 ... ... | 12.5 | 15.2 | 4.7 | |
| 22 ... ... | 9.3 | 12.3 | 3.0 | |
| 23 ... ... | 14.0 | 20.0 | 6.0 | |
| 24 ... ... | 14.5 | 11.4 | | 3.1 |
| 25 ... ... | 14.5 | 16.0 | 1.5 | |
| 26 ... ... | 16.0 | 14.0 | | 2.0 |
| 27 ... ... | 14.6 | 12.5 | | 2.1 |
| 28 ... ... | 13.0 | 15.2 | 2.2 | |
| 29 ... ... | 20.0 | 13.3 | | 6.7 |
| 30 ... ... | 15.2 | 16.6 | 1.4 | |

CONTROLS (NO ANÆSTHESIA) (*continued*).

| Case | Mgm. of Urea N. 1st Day | 2nd Day (24 hrs.) | Mgm. of Urea M. Increase | Decrease |
|---|---|---|---|---|
| 31 ... ... | 16.0 | 15.1 | | 0.9 |
| 32 ... ... | 14.0 | 20.0 | 6.0 | |
| 33 ... ... | 18.8 | 17.7 | | 1.1 |
| 34 ... ... | 16.0 | 16.2 | 0.2 | |
| 35 ... ... | 16.0 | 16.0 | — | — |
| 36 ... ... | 25.3 | 21.3 | | 4.0 |
| 37 ... ... | 20.0 | 21.3 | 1.3 | |
| 38 ... ... | 22.8 | 22.8 | — | — |
| 39 ... ... | 10.6 | 13.0 | 2.4 | |
| 40 ... ... | 9.0 | 14.0 | 5.0 | |
| 41 ... ... | 11.0 | 14.5 | 3.5 | |
| 42 ... ... | 14.0 | 17.7 | 3.7 | |
| 43 ... ... | 22.8 | 17.0 | | 5.8 |
| 44 ... ... | 12.8 | 20.0 | 9.2 | |
| 45 ... ... | 9.4 | 9.1 | | 0.3 |
| 46 ... ... | 14.4 | 16.3 | 2.0 | |
| 47 ... ... | 13.4 | 11.8 | | 1.6 |
| 48 ... ... | 16.0 | 13.9 | | 2.1 |
| 49 ... ... | 17.0 | 16.7 | | 1.7 |
| 50 ... ... | 25.6 | 15.2 | | 10.4 |

CHLOROFORM AND ETHER.

| Nature of operation. | Mgm. Urea N % Before | After (24 hrs.) | Mgm. Urea N % Increase | Decrease |
|---|---|---|---|---|
| Partial gastrectomy ... ... | 12.3 | 17.0 | 4.7 | |
| Appendicectomy ... ... | 32.0 | 32.0 | — | — |
| Reduction of fracture ... ... | 20.0 | 26.6 | 6.6 | |
| Fibro adenoma of breast removed | 10.7 | 11.8 | 1.1 | |
| Insertion of radium ... ... | 20.0 | 26.0 | 6.0 | |
| Appendicectomy ... ... | 20.0 | 20.0 | — | — |
| Tonsils and adenoids ... ... | 22.8 | 26.8 | 4.0 | |
| Excision of cartilage ... ... | 11.8 | 15.0 | 3.2 | |
| Excision of cartilage ... ... | 15.2 | 20.0 | 4.8 | |
| Hernia ... ... ... ... | 11.4 | 19.0 | 6.6 | |
| Excision of lipoma ... ... | 11.4 | 15.2 | 3.8 | |
| Hernia ... ... ... ... | 10.6 | 9.0 | | 0.4 |

CHLOROFORM AND ETHER (*continued*).

| Nature of operation. | Mgm. Urea N % Before | After (24 hrs.) | Mgm. Urea N % Increase | Decrease |
|---|---|---|---|---|
| Reduction of fracture ... ... | 12.8 | 11.9 | | 0.9 |
| Removal of sphenoid ... ... | 12.3 | 11.4 | | 0.9 |
| Tonsils and adenoids ... ... | 14.4 | 22.8 | 6.2 | |
| Tonsils and adenoids ... ... | 13.3 | 17.0 | 2.7 | |
| Mastoid ... ... ... ... | 11.8 | 15.0 | 3.2 | |
| Mastoid ... ... ... ... | 14.8 | 16.0 | 1.2 | |
| Tonsils and adenoids ... ... | 11.4 | 13.3 | 1.9 | |
| Mastoid ... ... ... ... | 16.8 | 14.5 | | 2.3 |
| Tonsils and adenoids ... ... | 11.0 | 11.8 | 0.8 | |
| Tonsils and adenoids ... ... | 12.3 | 17.3 | 5.0 | |
| Tonsillectomy ... ... ... | 13.3 | 20.0 | 6.7 | |
| Tonsillectomy ... ... ... | 11.4 | 16.0 | 4.6 | |
| Bursa excised ... ... ... | 12.8 | 12.3 | | 0.5 |
| Hernia ... ... ... ... | 16.0 | 15.4 | | 0.6 |
| Hernia ... ... ... ... | 11.8 | 14.5 | 2.8 | |
| Hernia ... ... ... ... | 11.8 | 13.9 | 2.1 | |
| Hernia ... ... ... ... | 14.0 | 24.0 | 10.0 | |
| Amputation of finger ... ... | 15.7 | 11.8 | | 4.0 |
| Removal of sequestrum ... | 11.0 | 11.0 | — | — |
| Gastric ulcer ... ... ... | 9.1 | 13.3 | 4.2 | |
| Mastoid ... ... ... ... | 14.5 | 13.9 | | 0.6 |
| Tonsils and adenoids ... ... | 11.8 | 12.3 | 0.5 | |
| Tonsils and adenoids ... ... | 24.0 | 16.8 | | 7.2 |
| Tonsils and adenoids ... ... | 13.9 | 11.9 | | 2.0 |
| Appendicectomy ... ... ... | 11.4 | 12.3 | 0.9 | |
| Hernia ... ... ... ... | 11.6 | 11.4 | | 0.2 |
| Reduction of fracture ... ... | 11.8 | 13.9 | 1.9 | |
| Hernia ... ... ... ... | 11.6 | 10.0 | | 1.6 |
| Oesophagoscopy ... ... | 16.8 | 12.3 | | 4.5 |
| Tonsils and adenoids ... ... | 7.0 | 12.0 | 5.0 | |
| Tonsils and adenoids ... ... | 8.8 | 10.6 | 1.8 | |
| Hernia and appendicectomy ... | 12.8 | 10.2 | | 2.2 |
| Tonsillectomy, osteomyelitis drained ... ... ... ... | 10.6 | 16.0 | 5.4 | |
| Oesophagoscopy ... ... ... | 9.0 | 12.8 | 3.4 | |
| Tonsils and adenoids ... ... | 15.4 | 14.9 | | 0.5 |
| Osteomyelitis drained ... ... | 11.4 | 21.4 | 10.0 | |
| Amputation of cervix ... ... | 12.3 | 11.5 | | 0.8 |
| Amputation of breast ... ... | 8.8 | 9.1 | 0.3 | |

STOVAINE.

| Nature of operation. | Mgm. Urea N % Before | After (24 hrs.) | Mgm. Urea N % Increase | Decrease |
|---|---|---|---|---|
| Hernia ... ... ... ... | 17.3 | 16.8 | | 0.5 |
| Hernia ... ... ... ... | 10.6 | 11.6 | 1.0 | |
| Papilloma of bladder ... ... | 20.0 | 24.0 | 4.0 | |
| Varicocele ... ... ... ... | 13.9 | 17.3 | 3.4 | |
| Injection of hæmorrhoids ... | 17.7 | 21.4 | 3.7 | |
| Hallux valgus ... ... ... | 26.6 | 16.8 | | 9.6 |
| Hallux valgus ... ... ... | 16.0 | 17.0 | 1.0 | |
| Hernia ... ... ... ... | 17.7 | 22.8 | 5.1 | |
| Hernia ... ... ... ... | 14.8 | 15.4 | 0.6 | |
| Anal fistula ... ... ... | 13.3 | 22.8 | 9.5 | |
| Hernia ... ... ... ... | 12.3 | 12.3 | — | — |
| Hæmorrhoids and urethral stricture ... ... ... | 24.0 | 21.4 | | 2.6 |
| Hernia (bi-lateral) ... ... | 13.3 | 20.0 | 6.7 | |
| Cystoscopy ... ... ... | 21.4 | 22.8 | 1.4 | |
| Carcinoma of colon ... ... | 13.9 | 15.4 | 1.5 | |
| Hernia ... ... ... ... | 17.7 | 20.0 | 2.3 | |
| Hernia ... ... ... ... | 20.0 | 17.0 | | 3.0 |
| Hæmorrhoids ligatured ... | 17.7 | 22.8 | 5.1 | |
| Hernia ... ... ... ... | 13.9 | 13.9 | — | — |
| Hernia ... ... ... ... | 17.5 | 11.4 | | 6.1 |
| Hernia ... ... ... ... | 16.0 | 26.6 | 9.4 | |
| Cystoscopy ... ... ... | 17.3 | 24.8 | 7.5 | |
| Hernia ... ... ... ... | 11.8 | 12.8 | 1.0 | |
| Hernia ... ... ... ... | 17.7 | 17.7 | — | — |
| Hydrocele of cord ... ... | 14.5 | 13.9 | | 0.6 |
| Hernia ... ... ... ... | 16.8 | 15.7 | | 1.1 |
| Hernia ... ... ... ... | 14.8 | 13.3 | | 1.5 |
| Hernia ... ... ... ... | 12.8 | 10.6 | | 2.2 |
| Cystoscopy ... ... ... | 12.3 | 13.3 | 1.0 | |
| Hernia ... ... ... ... | 13.1 | 9.0 | | 4.1 |
| Fistula in ano ..... ... | 14.5 | 12.3 | | 2.2 |
| Hernia ... ... ... ... | 12.3 | 9.1 | | 3.2 |
| Hernia ... ... ... ... | 18.0 | 14.2 | | 3.8 |
| Hernia ... ... ... ... | 16.3 | 12.3 | | 4.0 |
| Bursa of knee excised ... ... | 9.0 | 9.0 | — | — |
| Hernia* ... ... ... ... | 10.0 | 16.0 | 6.0 | |
| Hernia ... ... ... ... | 11.8 | 13.9 | 2.1 | |
| Hallux valgus ... ... ... | 10.6 | 15.4 | 4.8 | |

STOVAINE (*continued*).

| Nature of operation. | Mgm. Urea N % Before | After (24 hrs.) | Mgm. Urea N % Increase | Decrease |
|---|---|---|---|---|
| Varicocele. Radical cure ... | 10.6 | 13.1 | 2.5 | |
| Hernia* ... ... ... ... | 11.0 | 12.8 | 1.8 | |
| Hernia ... ... ... ... | 9.6 | 12.8 | 3.2 | |
| Hernia ... ... ... ... | 10.0 | 10.6 | 0.6 | |
| Hernia ... ... ... ... | 10.0 | 11.0 | 1.0 | |
| Hernia ... ... ... ... | 16.0 | 16.0 | — | — |
| Hydrocele of cord ... ... | 16.0 | 14.2 | | 1.8 |
| Hernia ... ... ... ... | 13.3 | 11.4 | | 1.9 |
| Removal of plate ... ... | 11.2 | 10.0 | | 1.2 |
| Hernia ... ... ... ... | 10.6 | 10.0 | | 0.6 |
| Hernia ... ... ... ... | 14.5 | 8.1 | | 6.4 |
| Cystoscopy ... ... ... | 32.0 | 40.0 | 8.0 | |

* Plus C. and E.

PERCAINE.

| Nature of operation. | Mgm. Urea N % Before | After (24 hrs.) | Mgm. Urea N % Increase | Decrease |
|---|---|---|---|---|
| Septic knee incised ... ... | 10.3 | 11.0 | 0.7 | |
| Hernia ... ... ... ... | 11.0 | 16.0 | 5.0 | |
| Skin graft ... ... ... | 22.8 | 22.8 | — | — |
| Hernia ... ... ... ... | 11.6 | 12.5 | 0.9 | |
| Hernia ... ... ... ... | 13.9 | 17.1 | 3.2 | |
| Proctoscopy ... ... ... | 11.6 | 14.5 | 3.0 | |
| Hernia ... ... ... ... | 10.6 | 14.5 | 4.1 | |
| Hæmorrhoids ... ... ... | 10.6 | 16.8 | 6.2 | |
| Hallux valgus ... ... ... | 12.3 | 11.8 | | 0.5 |
| Hernia ... ... ... ... | 12.3 | 12.3 | — | — |
| Hæmorrhoids ... ... ... | 12.8 | 13.9 | 1.1 | |
| Hernia ... ... ... ... | 16.5 | 11.5 | — | 5.0 |
| Hernia ... ... ... ... | 13.9 | 14.5 | 0.6 | |
| Appendicectomy ... ... | 10.0 | 13.9 | 3.9 | |
| Prostatectomy ... ... ... | 10.3 | 18.8 | 8.5 | |
| Appendicectomy ... ... | 9.0 | 12.3 | 2.7 | |
| Hallux valgus ... ... ... | 16.2 | 16.0 | | 0.2 |

PERCAINE (*continued*).

| Nature of operation. | Mgm. Urea N % Before | After (24 hrs.) | Mgm. Urea N % Increase | Decrease |
|---|---|---|---|---|
| Hernia ... ... ... ... | 12.8 | 12.8 | — | — |
| Hæmorrhoids ... ... ... | 14.2 | 13.9 | | 0.3 |
| Hernia ... ... ... ... | 16.0 | 12.3 | | 3.7 |
| Hernia ... ... ... ... | 18.8 | 15.2 | | 3.6 |
| Hernia ... ... ... ... | 15.4 | 14.5 | | 0.3 |
| Hernia ... ... ... ... | 14.8 | 14.5 | | 0.9 |
| Hysterectomy* ... ... ... | 11.3 | 16.3 | 5.0 | |
| Hernia ... ... ... ... | 11.4 | 12.3 | 0.9 | |
| Hernia ... ... ... ... | 13.3 | 13.3 | — | — |
| Nephrolithotomy ... ... | 14.4 | 14.0 | | 0.4 |
| Nephrolithotomy ... ... | 14.4 | 13.9 | | 0.5 |
| Cystoscopy ... ... ... | 12.9 | 11.4 | | 1.3 |
| Appendicectomy ... ... | 14.2 | 14.6 | 0.4 | |
| Removal of uretic calculus ... | 13.3 | 13.1 | | 0.2 |
| Carcinoma of rectum excised ... | 9.0 | 14.5 | 5.5 | |
| Cystoscopy ... ... ... | 10.0 | 12.3 | 2.3 | |
| Colostomy ... ... ... | 15.2 | 14.5 | | 0.7 |
| Appendicectomy ... ... | 9.1 | 9.1 | — | — |
| Scrotal hernia ... ... ... | 28.6 | 29.0 | 0.4 | |
| Catheterisation ... ... ... | 15.2 | 12.3 | | 0.9 |
| Appendicectomy ... ... | 11.4 | 15.0 | 3.6 | |
| Appendicectomy ... ... | 12.3 | 14.5 | 2.2 | |
| Gastro enterostomy ... ... | 20.0 | 14.5 | | 5.5 |
| Nephrectomy ... ... ... | 9.0 | 12.3 | 3.3 | |
| Nephrectomy ... ... ... | 9.4 | 13.3 | 3.9 | |
| Appendicectomy ... ... | 12.3 | 10.5 | | 1.6 |

* Plus Gas and Oxygen.

My best thanks are due to the Honorary Surgeons of the Dreadnought Hospital, Greenwich, for permission to investigate their cases; to the Director of the Devonport Pathological Laboratories, Greenwich, for affording me laboratory facilities; and to the Seamen's Hospital Aid Committee for a grant to carry out this research.

# COMBINED EVIPAN-NOVOCAINE ANÆSTHESIA.

By GEORGE BANKOFF, M.D., D.Ch., F.A.Ch. (Germany).

THERE is hardly any field in Medicine where more innovations or experiments have been tried than in the field of anæsthesia. This is certainly due to the fact that anæsthesia plays an important part in the success of a surgical operation. Very often the surgeon is faced with problems regarding the low general condition of the patient, with individual sensibility or diseases which, although having no direct connection with the operation itself, handicap its performance. For this reason the competent surgeon must be well acquainted with the different types of anæsthesia in order to enable him to select the best anæsthetic for a particular patient. Only in this way can an anæsthetic be administered without danger and as innocuous as possible for the organism. On the other hand the selected anæsthesia must not only render the operations completely painless but also enable the surgeon to perform it easily with the best surgical technique, and offer him all the conditions such as muscular relaxation, asepsis, etc., required for the performance and success of an operation.

Without criticising the advantages or disadvantages of different type of anæsthesia, I would say that in no circumstances where a low condition of the patient or particular sensibility of the organism makes the use of a particular type of anæsthesia dangerous, is the surgeon entitled to use it because he has for some reason or other preference for this type. Our operative statistics are full of the unsuccessful results of operations due only to the misuse of an anæsthetic. In many clinics abroad and in this country I have observed cases of simple operations, such as tonsilectomy, appendicitis or hernia, where the result has been fatal solely on account of the obstinacy and conservatism of the surgeon in giving preference to one type of anæsthesia.

Unfortunately by taking into consideration all these factors we must still recognize that at the present time we do

not possess an ideal method of anæsthesia, sufficiently competent to meet all the requirements necessary for the easy performance and success of an operation.

Such an ideal anæsthesia in the opinion of Professor Sebrechts must be able to suppress the anguish of the patient and entirely abolish sensation; affording the surgeon perfect muscular relaxation, a maximal retraction of the internal organs, and a bloodless operative field. Furthermore it must not intoxicate the patient, injure his vital functions, or cause post-operative complications.

In a previous work of mine, published in the *Lancet*, I brought to knowledge a new method of local anæsthesia which, in my opinion, not only dispenses with the disadvantages of the general or spinal types, but also allows the same possibilities of performing operations.

Although this type of local anæsthesia offers me a more or less ideal condition for the success of an intervention, I should like to admit that there are patients, particularly women and children, who are afraid to submit themselves to an operation under local anæsthesia. For this reason I have been experimenting with a new type of anæsthesia by combining the intravenous evipan-sodium anæsthetic with novocaine infiltration or blocking of the operative field. This combination has given surprising results, particularly when adopted for major operations.

*Evipan-Sodium as an Anæsthetic.*

A few years ago systematical experiments were begun with different derivatives of barbituric acid in trying to apply them as narcotics. In this way Croft and Taub were able to isolate N.-methyl. C.C. cyclo hexemyl methyl barbituric acid, which they called evipan. It was found that this drug was capable of inducing an easy and deep sleep, bringing the subjects into complete anæsthesia. Fairly large amounts of drug could be injected without any danger, and therefore the evipan gave hopes of being able to offer an ideal condition for general anæsthesia. The only difficulty stood in the fact of having the evipan in reliable solutions, but even this way was overcome by obtaining a sodium salt of this drug. The evipan-sodium solution is very unstable,

and therefore it must always be fresh, being prepared just before the injection.

Surmounting the difficulties of the preparation of the drug, Wesse started a systematic study of the effects of evipan-sodium on animals and the condition of anæsthesia which it produced on them. It was found that as soon as the solution was injected the animal became quiet, lowered its head, and the respiration became slower but maintained its rhythm. No particular phenomena was observed during the sleep of the animal, with the exception that during the awakening a light tremor and small fibrillary twitching were present. It was established that the action of the drug was increased by injecting the solution rapidly. The intoxication of the animal began by injecting 25 m.gr. per kilo of body-weight which often ended in complete narcosis. This amount varied slightly in different animals, for instance in dogs, to 30 m.gr. The maximum dose established was 100-110 m.gr. of evipan-sodium per K.gr. of body-weight. By exceeding this maximum dose death occurred in the animal from respiratory failure. These experiments on animals with so surprisingly encouraging results justified the application of the drug as a general anæsthetic on man. Monod found that evipan-sodium has a rapid action but also an equally rapid rate of recovery. This investigator observed that after 15 minutes the corneal reflex reappears, the patient reacts to pricks, replies to questions after 20-30 minutes, and in one hour's time the recovery is complete.

The metabolism of the evipan-sodium is effected by a chemical process of disintegration which takes place in the liver. The complete detoxication is very rapid; for instance, a rabbit disposes of its maximum dose in about 20 minutes. Owing to these properties the evipan-sodium is very much like the ethyl chloride, particularly in the rate of recovery. It was found that evipan-sodium injection produced no ill-effects even when injected in cases of emergency, and therefore the patient does not require any particular preparation, although Kaspar advises the use of evipan-sodium on an empty stomach. Furthermore, no damage on various organs has been found. The composition of the blood is unchanged and the liver is unaffected, although the metabolism of the evipan takes place in the former, and traces

of the drug have very rarely been found in the urine. The fall of the temperature is very slight; on the other hand the blood-pressure is lowered to a noticeable degree. Lauber gives 20-30 m.gr. of Hg. as a normal fall of the blood-pressure which does not arouse any anxiety. The pulse-rate remains normal, being occasionally only slightly increased; the respiratory movements, although regular, are slightly lessened in their depth and frequency. The muscular tone is affected differently according to individuals, sometimes contraction of the skeletal muscles is found while those of the abdominal wall are relaxed. The corneal reflexes are already abolished by the small doses and the pupils are moderately dilated. However this is not always the case, as some observers have found them contracted or even not affected at all.

## ASSOCIATION OF ANÆSTHETISTS OF GREAT BRITAIN AND IRELAND.

THE Annual General meeting was held on Thursday, the 31st October, at the Medical Society, Chandos St., W.1, at 8.30 p.m. Dr. H. W. Featherstone (President) in the chair. About fifty members were present.

The minutes of the last General Meeting, which had been circulated, were taken as read and signed.

The President referred to the sad loss which had been occasioned to the Association by the tragic death of Dr. Howard Jones. An appeal fund had been raised by the Association to help Mrs. Howard Jones and children, to which members had responded generously, seventy having already contributed. More than £250 had been raised to date, including a donation of £10 10s. from the Association's funds. *The British Journal of Anæsthesia* had made a generous donation. The fund was to be closed in about a month's time. Nearly £200 had already been sent to Mrs. Howard Jones, who had written in terms of deepest gratitude to the Association. The President said that he had written a letter of sympathy to her on behalf of the Council.

Dr. Hadfield proposed a vote of thanks to Dr. Featherstone, Dr. Blomfield and Dr. Ramsey Phillips for the active steps they had taken in connection with this appeal. This was seconded by Dr. Hughes and carried unanimously.

Dr. Featherstone thanked the Association for its confirmation of their action.

The President proposed a resolution that the second sentence of Rule 7 ("Return railway fares shall be paid to provincial members of the Council for attendance at one Council meeting each year.") should be rescinded and the following inserted in its place: "Third class railway fares shall be paid to provincial members of Council for each attendance at Council meetings" and that this new rule should apply for the past year (1934-1935). He pointed out that in order to make the Association representative of the country it was necessary to encourage provincial members

to attend Council meetings. It would involve an expense of about £40 to £50 a year.

Sir Francis Shipway proposed an amendment that the rule should read: "Third class return railway fares."

The President moved the resolution with this amendment which was seconded by Sir F. Shipway and carried unanimously.

The President presented the Council's report for the year, of which the following is a summary:—

"The Association is in a flourishing condition as regards funds, while the membership roll will soon reach the limit of 150 which is prescribed by the Rules.

The tragic death of the late Howard Jones, who was Honorary Secretary of the Association from the time of its inception, has caused an irreparable loss, and it has served to strengthen our view that much remains to be done in order that the practice of anæsthetics shall be placed upon a sound financial basis.

There have been seven meetings of the Council, and the several sub-committees have met as required. Members of the Council have shown great interest in the work which they have been called upon to deal with, and there has been complete unanimity in the decisions which they have taken.

Co-operation has been established with the Australasian Society of Anæsthetists and also with the newly formed Italian Society of Anæsthetists. Dr. Mennell has visited Australia in connection with the B.M.A. meeting, where he delivered the second Embley Memorial Lecture. Dr. Mennell conveyed our greetings to the Australasian Society of Anæsthetists.

In answer to the request of the British College of Obstetricians and Gynæcologists, Dr. Mennell has served as the representative of anæsthetists on the Committee upon Analgesia in Midwifery. Help or advice has been given in various matters of local hospital policy which have been submitted to the Council.

Largely through the influence of Dr. Claude Morris, University College Hospital has decided to appoint an anæsthetist to the Surgical Unit, whose salary is to be paid from

the Unit's funds. An effort is being made to increase the amount of the salary for this officer.

At the last Annual Meeting the Council was given power to negotiate with the Royal College of Surgeons of England with a view to establishing a Diploma in Anæsthetics. Four of your representatives (Dr. Blomfield, Dr. Hadfield, Dr. Magill and I) met the President and representatives of the Council of the Royal College of Surgeons. Much interest was shown. It was suggested that the Conjoint Board should undertake the Diploma, to bring it into line with the other Diplomas in Public Health, Ophthalmology, etc. A detailed scheme was asked for and your representatives then discussed the matter with Mr. Rew, the Secretary of the Examining Board in England. Armed with the schedules of other Diplomas, your Diploma Sub-Committee drew up a draft schedule for the Diploma which was discussed in detail by the whole Council. After minor alterations this was sent to the President of the Royal College of Surgeons and he submitted it to a committee of the Royal College of Physicians. Upon this committee Dr. Morris was appointed to serve by the Council of the Royal College of Physicians. Finally the Committee of Management of the Examining Board in England received your representatives and approved the schedule. There was general agreement upon nearly all the points which were discussed, but the principle of election to the Diploma without examination was not accepted by the Royal Colleges until strong representations were laid before them. We pointed out, ***inter alia***, that there was precedent in the case of the Fellowship diploma of the Royal College of Surgeons, and that while we did not seek for an examination which should be difficult or highly competitive, we sought for a hall-mark which should signify that an anæsthetist possessed satisfactory skill and knowledge. If the Diploma was to be come a force in anæsthetics within the next few years, it was essential that the acknowledged anæsthetists of the country should possess it. The authorities insisted that the terms of this process of election should be explicit, and, as you are aware, for three years from the date of inauguration of the Diploma, an anæsthetist of ten years' standing at the main teaching hospital of a medical school is eligible for election to

the Diploma without examination. We regard the principle to be of the utmost importance in establishing the Diploma, and it is our unhesitating belief that the award of the Diploma to leading anæsthetists will strengthen the speciality of Anæsthesia.

The subject of Coroners' Inquests upon patients who have died under anæsthetics has progressed satisfactorily. Personal interviews by Dr. Mennell and Dr. Magill with the authorities at the Home Office, including the Home Secretary (who was most helpful) led to an official request which I submitted to the Home Secretary that we should be allowed to submit evidence before the Departmental Committee on Coroners which had just been set up. Lord Wright, the Chairman of the Committee, invited a written statement. The statement was prepared with great care and printed copies were circulated among the members of the Committee. At the interview at the Home Office, in the early summer, Dr. Mennell, Dr. Magill and I were well received, and the whole matter was examined with complete frankness. It was agreed that we had established our case and we were asked to prepare a list of suggestions for alterations in the conduct of these inquests. This has been done, and at the end of August copies of these suggestions were laid before Lord Wright and members of the Committee. We are now awaiting further developments.

This has been a year in which great progress has been made in establishing Anæsthesia as a regular department of Medicine, and your Council submit this report in the belief that you will be satisfied and in the hope that yet further progress will be made in the ensuing twelve months."

It was proposed by Dr. Ashworth and seconded by Sir F. Shipway that in future a copy of the Council's report should be circulated to members before the Annual General Meeting. This was carried unanimously.

In the absence of the Treasurer the President read the financial report for the year ending June 30th, 1935. The report, which showed a balance of £341 11s. 5d., was adopted unanimously.

The question as to the use of the Association's funds was raised by Sir Francis Shipway and the matter was discussed

with the possibility of investments being made. It was finally decided that no definite decision should be taken until after the Treasurer's return from Australia.

Dr. Magill and Dr. Sykes acted as scrutineers over the ballot.

*The following officers were elected*:—

| | |
|---|---|
| President | Dr. Blomfield. |
| Vice-President | Dr. Hadfield. |
| Hon. Secretary | Dr. Featherstone. |
| Hon. Treasurer | Dr. Mennell. |

*The new members of the Council elected were*:—

| | |
|---|---|
| Sir F. Shipway. | Dr. Langton Hewer. |
| Dr. F. J. Clausen. | Dr. Harold Sington. |

*The retiring members of the Council being*:—

Messrs. Apperly, Ashley Daly, and Ramsey Phillips.

*The following condidates were elected members of the Association*:—

Dr. H. E. K. Eccles (Royal Sussex Hospital, Brighton).
Dr. N. A. Gillespie (London Hospital).
Dr. F. C. Gibbs (Royal Infirmary, Edinburgh).
Dr. A. P. Gorham (Bristol General Hospital).
Dr. J. B. Holroyd (Sheffield Royal Infirmary.)
Dr. E. Landau (St. George's Hospital).
Dr. H. C. Roberts (Liverpool Dental Hospital).
Dr. L. B. Wevill (Royal Infirmary, Edinburgh).
Dr. Rose E. Williams (Manchester).

After the election of officers and candidates Dr. Blomfield took the chair and thanked the Association for electing him President.

With regard to the payment of anæsthetists Dr. George Edwards proposed that any anæsthetist receiving an honorarium at the present time should give it up and that the Council should take no immediate steps to procure payment for anæsthetists, as the whole question of the payment of the Honorary Staffs was coming up in the near future and it would be advisable for anæsthetists to place themselves on

a basis with the rest of the Honorary Staff and for the cases to be dealt with together.

This was seconded by Dr. McConnell and discussed, the following members speaking: Messrs. Greaves, R. Phillips, Hedley, Boyle, Vaile and Daly.

Mr. Boyle moved the amendment that the matter should be left entirely to the sub-committee appointed to deal with the question and that they should report to the Council and the Association. This was seconded by Dr. Vaile, and Dr. Edwards withdrew his resolution. The amendment was carried. Members were asked to write their suggestions and views to the sub-committee.

Dr. Sykes brought up the question of an anæsthetic museum. This was briefly discussed. Dr. Blomfield informed Dr. Sykes that the Royal College of Surgeons had a collection of anæsthetic apparatus, chiefly left by the late Dr. Dudley Buxton, and members wishing to do so could add to this collection.

After a vote of thanks to Dr. Featherstone for his services as President of the Association, and one to the members of the Council for the work they had done during the past year, the meeting was adjourned.

## ROYAL SOCIETY OF MEDICINE

### Section of Anæsthetics.

AT the opening of the session on November 1st, Mr. H. A. Richards, the new President, gave an address. After a brief history of inhalation anæsthesia, he continued:

"In 1859 Niemann discovered the alkaloid of Coca leaves to which the name of cocaine was given, the first step in the history of spinal analgesia. The discovery by Schraff of the local analgesic properties of this substance when placed upon the tongue and the application of the latter discovery to surgical purposes suggested by Koller in 1884 made the second step fairly initiating the history of spinal analgesia. Corning's experiments on prolongation of effect of cocaine given under the skin followed, the logical antecedent to his experiments with local medication of the cord. Next Quincke found it was possible to remove a considerable amount of cerebrospinal fluid without danger to the subject. Despite the fact that Corning had in his original contribution suggested the surgical application of the method no such trial was made until Bier of Kiel demonstrated its feasibility and published the result of his work. Soon afterwards Barker in this country adopted spinal analgesia, using stovaine instead of cocaine, which had proved too dangerous. Felix Rood a little later proved that it was safer to have the patient in the Trendelenburg position instead of sitting up as had been previously taught. Recently the fine work of the late Howard Jones with percaine has done much to extend the field of spinal analgesia.

Let me show very shortly how much better off is the anæsthetist of the present day than his predecessor at the beginning of the century.

The latter had at his disposal chloroform, ether and nitrous oxide with almost no mechanical aid, and a primitive mask or the corner of a towel to make one. True, Clover's inhaler was in use, but the absence of hypodermic atropine made it difficult and unsafe to use, because of the salivation

and consequent chest complications. Personally I consider the use of atropine as the drier up of secretions one of the greatest advances since the orginal discovery of anæesthetic drugs. When I think of the first cases of open ether which I saw as a student I am filled with amazement that all the patients did not die of pneumonia, and that everybody in the theatre was not half-anæsthetised by the ether fumes. An inefficiently padded mask was used and ether literally poured on from a very large bottle, with a Winchester of ether in reserve to replenish the original bottle. Ether vapour everywhere, and a large fire in the corner of the theatre, but curiously enough never an explosion, or even the thought of one. No wonder that chloroform was looked upon by some as a safer anæsthetic. Atropine has changed the whole outlook, and ether came into its own as the basis of modern inhalation anæsthesia. Now see what the modern anæsthetist has in his armamentarium:

*Pre-operative*: Hypodermics, atropine, morphia, omnopon, scopolamine.

*Intravenous*: Evipan, nembutal, pernocton.

*Rectal*: Avertin, paraldehyde, ether oil.

*Oral*: Nembutal, bromides, chloral, chloretone.

*At operation*: Chloroform, ether, nitrous oxide, cyclopropane, vinyl ether; high and low spinal injection, with percaine, novocaine, heavy or light stovaine, and planocaine; and Pitken's tiltometer if he likes. Intubation of the larynx by nose or mouth and all the different gas-and-oxygen machines to which the tube may be attached. Boyle's, Walton's and McKesson's machines.

This is a formidable list, and suitably used should make for greater safety and post-operative comfort. The question always arises in my mind, does one do one's best purely from the patient's point of view? Having developed a liking for a particular method or drug are we not inclined to allow our liking to outrun our judgment? Do we not sometimes inflict on a patient post-operative discomfort which might have been avoided by some other method? Cannot we bring ourselves to look at the whole situation more from the patient's point of view? I speak with feeling

because many times I have been at the mercy of anæsthetists. I admit that pre-anæsthetic drugs are now almost universally used and with enormous advantage to the patient. It is after this that I am in doubt. For example, why use spinal analgesia for an appendix or hernia when a simple anæsthetic answers perfectly well? The patient may vomit, or get a chest complication, as he may indeed after spinal, but he does not run the risk of a headache for three weeks, or nerve palsy, or paresis of sphincters, all of which I have seen more than once. Endotracheal anæsthesia has great advantages in rendering possible operations requiring positive pressure, and certain positions of the patient, and in keeping the anæsthetist off the sterile field, but I see certain risks in the nasal method of applying it. These are, troublesome epistaxis, and the conveyance of sepsis from nose to trachea. A patient underwent partial gastrectomy, and the nasal method was employed; ten days later he died of lung abscess. I wonder if that would have happened without the nasal intubation? I believe many sore throats are due to this procedure.

Again I sometimes doubt if we use all the drugs at our disposal to their best advantage. Take evipan for example. This was provided for use in minor operations and I cannot believe that it was intended as an anæsthetic for major surgery. My experience shows it to be uncertain in action and surely not to be relied on for surgical anæsthesia with proper relaxation. Some method may, of course, be devised whereby evipan may be given continuously with better and more certain results. Then I shall certainly try it for long operations.

Anæsthetics in midwifery have lately attracted much attention. The National Birthday League is financing research at several institutions to see whether every woman in labour may not be relieved of at least some of her pain. There are many reasons why this ideal is at present unattainable.

(1) Most of the midwifery of this country is carried out by midwives, who are not allowed to use anything stronger than chloral hydrate and potassium bromide.

(2) Numbers of confinements take place in the patient's home, where continuous supervision by a doctor is impossible.

The ideal could be achieved only if every woman went into an institution before labour started, if labour took place at a certain hour and was completed in a definite time. Instead of which labour begins at any time, often in unsuitable surroundings and without trained assistance. Most anæsthetics prolong labour with detriment to mother and child. Let us look at our sedatives and anæsthetics for labour.

Chloral hydrate, potassium bromide, opium in the form of morphia or omnopon, and nembutal. As pre-anæsthetics we have avertin and paraldehyde, neither satisfactory owing to the chance of extrusion during a pain. As anæsthetics we may use chloroform, ether, gas and air, or gas and oxygen. Chloroform is cheap, portable and non-explosive, an important point while so many labours take place in small rooms with open fires. The frequency and strength of uterine contraction are, however, diminished, and worse still is the effect of chloroform on the cells of the liver. The danger is great if the patient has more than one administration at short intervals, for instance for examination, induction of labour, and later for version and for delivery. At King's College Hospital chloroform is never used in the labour ward. This is the kind of thing we fear: A healthy primigravida became noisy and uncontrollable in labour, and was given chloroform for a short time till spontaneous delivery. About two hours later it was reported that she was bleeding steadily, although the uterus was retracted. The bleeding was found to come from a tear in the cervix. For repair of this she was again given chloroform. In twenty-four hours she became jaundiced and died in sixty hours after delivery from hepatic toxæmia. The chloroform capsules containing 20 minims undoubtedly assist the doctor working single-handed. If more than about twelve are used, however, the risk of toxæmia may arise.

Ether may be used by inhalation or rectally. It, too, certainly diminishes the strength and frequency of the pains. Caution is needed because of its inflammability. Gas and oxygen is, if available, the anæsthetic of choice for labour. As a rule it does not inhibit either the strength or the frequency of pains. The best results are obtained when the patient has had either nembutal by the mouth or morphia

and scopolamine beforehand. It is interesting to observe how after about an hour of the intermittent administration the patient sleeps between the pains, as though the effect of the gas were cumulative. Minnitt's apparatus is a great advance towards analgesia for every labour. The accoucheur can work single-handed if the patient is intelligent and co-operates. Considerable relief can be given without interfering with the progress of the labour. The handicap to the machine is its weight with the 20-gallon cylinders attached. If the new light cylinders are used the apparatus becomes unstable. If the rules were altered and midwives permitted to use gas-and-air, the apparatus would necessitate the use of a car and a strong man to carry it upstairs. Universal anæsthesia for labour would in my opinion entail a certain amount of delay in the pains which will sometimes be followed by hurried delivery with forceps and ultimate distress for the mother.

*Teaching of students.* This is a matter of grave concern to all anæsthetists on the staff of teaching hospitals. I have the anæsthetic clerk for one month, during which time he is expected to learn how to give anæsthetics—an impossible situation. The bulk of students become general practitioners and are supposed as such to be able to give an anæsthetic with fair success. At a loss what to teach them in the way of giving anæsthetics, I rather teach them what not to do. For example, my clerk may look into a patient's eye, but he may not touch the cornea, and he is not allowed to have a cyanosed patient. I do teach him to observe the patient's breathing, and having got the patient past the excitement stage to apply to the breathing his physiological knowledge of what happens to the respiratory centre when it is stimulated or depressed. One's difficulties are increased by divided loyalties between patient, surgeon and other occupants of the theatre. For the patient it is no doubt always best that he should have a preliminary drug. Will my clerk be able to continue this in practice, or must he be shown anæsthesia without preliminaries? Again, if for my clerk's benefit I leave the patient to him the surgeon is likely to suffer from insufficient narcosis. I try to steer a course which will instruct the student, not too greatly impede the surgeon, and not have too uncomfortable an amount of

ether about the theatre. I do not attempt to teach gas-and-oxygen with complicated apparatus. For routine work I teach the student to use Clover's inhaler, starting with gas into the rebreathing bag. For continuance he is taught semi-ether from a well-padded mask, which has a tube led through it permitting oxygen or $CO_2$ at will. Chloroform is shown only if the occasion arises when it is to the patient's benefit. The student is shown the art of oral intubation of the larynx, and if he meets an edentulous patient towards the end of his month generally succeeds in passing the tube. He is shown how to do lumbar puncture, but is not allowed to do it.

*Deaths under or associated with anæsthetics.* The Registrar-General's figures fill one with dismay. In 1921, for example, 204 men and 133 females are grouped under this head, a total of 347. Now look at the figures for 1931 to 1933. In 1931 these are: Men 413, women 310, total 723. In 1932, 416 and 333, total 749, and in 1933, men 425, women 343, total 768. These figures appear to show that since 1921 the death-rate associated with anæsthetics has been more than doubled. Naturally the figures are of little value without those of operations done. Let us hope that the number of operations in England and Wales during the later years were more than double those of 1921."

The discussion which followed was chiefly devoted to the teaching of anæsthetics. Mr. Ashley Daly maintained that as the general practitioner inevitably has to employ chloroform, the student should be instructed in its use. Mr. H. P. Crampton contended that chloroform is safe only in expert hands, and Dr. H. P. Fairlie was so convinced of its inevitable danger that students should be taught to avoid it. Dr. Cecil Hughes believed in the teaching of open ether, but that the student should also be taught to induce anæsthesia with a mixture of ether and chloroform. Mr. Jarman said that he had now an improved method for continuous evipan anæsthesia.

Mr. I. W. Magill said he had abandoned the routine use of atropine except for children. He preferred a suitable dose of omnopon and scopolamine, which was free from the disturbing tachycardia and palpitation sometimes observed

when atropine was given alone. He had not found any disadvantageous secretion of mucus when using the combination mentioned.

With regard to risks associated with nasal intubation he had used the method consistently for many years. He could say without exaggeration that his experience now covered some thousands of cases.

From his observations and experience he was absolutely convinced that the incidence of epistaxis and other traumatic conditions associated with nasal intubation was in direct proportion to the precautions taken and to the dexterity of the anæsthetist.

## ABSTRACTS

*"Bodily measurement and anæsthesia."* *Lancet,* October 26, 1935, p. 972.

It has never occurred to the anæsthetist that he might find an indication of his patient's reaction to anæsthetics by measuring his legs and his trunk. Piney, however, points out that in seventeen instances in which the leg-length, measured from the top of the great trochanter to the heel, was greater than the trunk-length, from the top of the great trochanter to the vertex, these pecularities were also present:

(1) The aorta was strikingly narrow.

(2) The thymus gland was present and varied in weight from one-quarter to one and one-quarter ounces.

(3) The spleen was rather large, and the Malpighian bodies were strikingly prominent.

(4) Mesenteric glands were unusually large and numerous.

Two of the seventeen post-mortems were on the victims of sudden death during anæsthesia; the other fifteen were on suicides. The seventeen were in a series of 500 post-mortem examinations. Piney concludes that persons with leg-length more than 50 per cent of the total body-length are liable to sudden death under anæsthesia, as well as being potentiallly suicidal. He adds: "It seems to be possible that some anæsthetic deaths would be avoided if measurements were taken before anæsthesia were started."

*"Treatment of Hirschsprung's disease by spinal anæsthesia."* *New Orleans Med. Surg. Journ.,* August, 1935, p. 83.

Congenital idiopathic megacolon, Hirschsprung's disease, is obstinate constipation without organic obstruction. The colon often becomes enormous, and the child's abdomen tense and thin-skinned. On the theory that the condition might be due to autonomic inco-ordination with sympathetic preponderance surgeons have carried out section of the lumbar sympathetic nerves with good results. Later,

spinal anæsthesia was tried for the same purpose and succeeded. The article gives in detail two more examples, in children of eight and nine years, in whom intra-spinal injection of novocain for Hirschsprung's disease gave most satisfactory results.

*"Seven years of spinal anæsthesia in private practice."* *Canadian Med. Assoc. Journ.*, Sept. 1935, p. 298.

Although the author puts forward nothing new, except some minor technical devices, this article is worth reading for its level-headedness. The devices alluded to are: (1) constant use of the Sise thumbstick and (2) "bull-dog" tie-pin fastener threaded backwards on the needle and pushed up to the shoulder before the puncture is made, in order to secure that the needle is not pulled out or pushed in at all when the injection is made. The author uses novocain, and for long anæsthesia nupercaine in 1 to 1000 solution. He found that combination of the two gave him both the best prolonged anæsthesia and the worst reaction. He records no fatality. He uses habitually premedication by barbiturates, as well as morphia and hyoscine half an hour before operation.

*"Kirschner's interrupted method of spinal anæsthesia."* L. STECHER in *Wiener Klin. Woch.*, No. 41, 1935, p. 128.

The author discusses the *rationale* of different methods of producing analgesia by endothecal injection, and explains his preference for that of Kirschner. This is a somewhat complicated process for the carrying out of which a double syringe is employed. Air is injected into the spinal canal as well as the anæsthetic solution. The dose is not given all at once but in small quantities, which are augmented in accordance with the need shown by testing the height of analgesia reached. Percain is the chosen anæsthetic agent. Great exactness in localisation and absence of ill effects on blood-pressure are the chief advantages claimed.

*"Avertin in thyroid surgery."* K. M. HEARD, in *Canadian Med. Assoc. Journ.*, October, 1935, p. 395.

The author has investigated the current literature dealing

with avertin during the years 1932–34, as shown by five journals in which he examined articles on the same subject during 1926-27 and 1910-31. He records a great increase in the employment of avertin, 13,600 administrations being dealt with in the latest period. Only four writers showed dissatisfaction and their experience was limited to 43 cases, as distinct from the 13,627 cases of the other observers whose general conclusions ranged from satisfaction to enthusiasm. Little mention was made in these records of avertin for thyroid work. The author has come to regard the drug as of pre-eminent value in this brand of surgery. His report deals with sixty cases, entirely unselected. Nitrous oxide was the anæsthetic employed and was generally started half an hour after injection with avertin. No other preliminary was used and high percentages of oxygen were given with the gas. The usual dose was 100 mgm. per kilo of body weight.

*"Allergic shock from local and general anæsthetics." Anæs. and Analg.*, September–October, 1935, p. 199.

The author seeks to explain sudden unexpected deaths associated with anæsthesia on the basis of their analogy to death from anaphylaxis. He maintains that the post-mortem findings are the same in the two kinds of fatality, and that in the case of local anæsthetics which have resulted in death, there is local oedema at the site of injection, which is analogous to the allergic skin reactions seen on injecting a sensitive subject. His arguments, intended to prove that sudden death in connection with general anæsthesia is often allergic, appear unconvincing.

*"Treatment of cancer by anæsthetics." Anæs. and Analg.*, September–October, 1935, p. 205.

A novel therapeutic use for ether and chloroform is recommended by Dr. R. W. Benner, who believes that these drugs taken by inhalation can play an important part in the treatment of cancer. Dr. Benner arrives at this conclusion along two paths of reasoning. Firstly, he maintains that pathological cell-division, which is cancer, takes place only in the presence of alkalosis. The normal tissue cell is maintained in a medium or serum with a definite acid-base equilibrium, 7.38. In acidosis the hydrogen-ion

content of the blood lies between 7 and 7.38; in cancer the alkalosis rises to 7.8 (we are quoting Dr. Benner). The stimulus behind all cell-growth is the chemical reaction of the serum surrounding the cells; natural replacement of worn-out cells, the normal process, takes place when the acid-base equilibrium is 7.38, pathological reproduction when it is definitely above this, or approaches 7.8. When abnormal cell-division takes place, the two pathological cells formed are forced by the same influence which forced their mother-cell to divide, and they behave in the same way. This multiplication will continue until the stimulus (i.e. the abnormal hydrogen-ion content) has been returned to normal. As malignancy, according to Dr. Benner, can only occur in the presence of alkalosis, acidosis is the obvious remedy. Ether and chloroform lower the alkali reserve, producing acidosis; therefore they must be employed in the treatment of cancer. The second argument is that many instances are on record where the mere examination of a malignant growth under anæsthesia has been followed by reduction of the growth, or greatly slowed increase. This is attributed by Dr. Benner to the anæsthetic, and it is certainly true that no explanation of the phenomenon any more convincing has hitherto been put forward. Hopefully, therefore, according to his view of the cause of the benefit obtained, he recommends repeated inhalations at intervals of either ether or chloroform. The speculation is interesting, but we believe many will dispute the major premise, that malignancy depends on the presence of alkalosis.

*"Wine enemata."* ***Anæs. and Analg.***, September–October, 1935, p. 71.

Wine as a pre-medication, and also as an anodyne after operation, has been given *per rectum* in more than two hundred cases. From one to three hundred cubic centimetres were given by slow injections before giving the anæsthetic. Port is stated to be the best type of wine to choose. In every instance the sensitivity of the patient is said to have been dulled to the extent of rendering him a favourable subject for whatever form of anæsthesia was subsequently induced. After operation the wine is given by a slow drip, about a

pint being put into the enema can and the effect produced never being allowed to reach the stage of intoxication. The results, not unnaturally, were pleasing.

*"Post-anæsthetic Conjunctivitis."* *Brit. Med. Journ.*, Oct. 19th, 1935, p. 762.

In a letter the writer alludes to a rare but effective cause of conjunctivitis after anæsthesia. He says, "Under general anæsthesia there is not only diminished secretion (of tears) but separation of the lids. Should this occur in a patient suffering from chronic dacryocystitis it is inevitable that the conjunction will be reinfected from the chronic focus, and that the acute conjunctivitis will result." Post-anæsthetic conjunctivitis is, of course, a preventable complication, that should never occur, and does not if the eyelids are kept properly closed throughout anæsthesia.

*"Usefulness of anæsthetic agents."* L. S. MUNDY, *Canadian Medical Association Journal*, November, 1935, p. 490.

The author mentions interesting examples of the less usual purposes for which anæsthetics may be employed. These include sea- and air-sickness, treated by barbiturates. Although carbon-dioxide and oxygen are not really anæsthetics, the mixture figures so largely in anæsthetic's practice that the author may be excused for introducing a description of its use to control hiccup. A more unusual reason for its therapeutic employment is alcoholic intoxication. "Administration of five per cent carbon-dioxide to 95 per cent oxygen will restore the patient from relative inebriation to relative sobriety in a very short time."

*"Dental anæsthetics."* *Brit. Dental Journ.*, July 15th, 1935[1] and October 15th, 1935, p. 436.[2]

Jarman[1] describes a method which he has found highly successful with children. It involves the use of a machine by which used nitrous-oxide can be given at slight pressure. Induction is started with a nose-pad lightly imposed and a soft cloth pad over the mouth on to which two or three cubic centimetres of ethyl chloride are squirted; this is removed when the child is asleep and nitrous-oxide given continuously, supplemented with oxygen and five per cent carbon-dioxide. A small marine sponge is used to shut off the nasopharynx

and to prevent any tooth, etc., from being drawn in during the extractions. The inconvenient affer-effects of purely ethyl-chloride anæsthesia are avoided, while its advantage of rapid induction is gained.

Beckett[2], in discussing the choice of dental anæsthetics, says, "The real question is to decide at what age a child is too young to take gas satisfactorily." By using the method just described gas can obviously be employed for every age at which extraction with an anæsthetic is required. Without that method it is probably correct, as Beckett states, that under about the age of ten years "it is generally useless to try and produce satisfactory anæsthesia with gas, or gas and oxygen." For adults, in the vast majority of instances, he selects gas and oxygen by the nasal route, but points out how many patients are best treated, not in the dental chair, but in a nursing home where prolonged anæsthesia can be safely and conveniently maintained. He disapproves of chloroform for any dental operation.

*"The relief of pain during labour."* L. C. Conn and J. R. Vant in *Canad. Med. Assoc. Journ.*, November, 1935.

The authors describe the use of many drugs and their combinations, but the details of the report concern over 400 patients treated mostly with barbiturates assisted by morphia or hyoscine and finally nitrous oxide. In a separate series of over 190 nembutal and was used in association with rectal paraldehyde and olive oil. A certain number of patients needed treatment for restlessness. For this purpose pernocton was used by the vein. For the most part three to six grains of nembutal was given first and repeated usually from half an hour to one hour afterwards every one to four hours. The repeated doses were half the size of the original dose. In a good many instances one or two of the later doses of nembutal were replaced by hyoscine (1/200th gr.). In primiparae 84.2 per cent obtained satisfactory amnesia, but in multiparae only 53.1 per cent. When paraldehyde was used it was given in doses of 6 to 8 drachms to 1 ounce of olive oil. This followed one half to one hour after 6 grains of nembutal. The authors are pleased with the results of their method but point out it is not effective unless started early in labour and under medical control throughout.